Before the
**FEDERAL COMMUNICATIONS COMMISSION**
Washington, DC 20554

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| In the Matter of | ) | |
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| Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service | ) | IB Docket No. 17-95 |

To: The Commission

**REPLY COMMENTS OF**
**THE BOEING COMPANY**

The Boeing Company ("Boeing") provides these reply comments to express its support for many of the comments that were filed in this proceeding supporting the introduction of satellite earth stations in motion ("ESIMs") in additional frequency bands, while reducing regulatory impediments to their licensing and operation. Boeing also addresses the comments of certain parties that appear to have misconceptions about the characteristics of ESIMs, which for nearly two decades have successfully operated in spectrum allocated to the fixed-satellite service ("FSS") without increasing the risk of interference to FSS networks or other authorized users of the same or adjacent spectrum.

## I. THE COMMISSION SHOULD TAKE ADDITIONAL STEPS TO PROMOTE THE OPERATION OF ESIMS WITH FSS NETWORKS

In supporting the operation of ESIMs with FSS networks, Boeing concurs with the position of SES and O3b that a Further Notice should be adopted in this proceeding to adopt rules and authorize the operation of ESIMs with FSS networks employing non-geostationary

satellite orbit ("NGSO") constellations.[1] NGSO FSS systems will provide critical advantages to ESIMs, such as robust and uninterrupted coverage of polar regions where international air traffic is increasingly concentrated. ESIMs will also provide additional maritime coverage opportunities for NGSO FSS systems employing low Earth orbit ("LEO") satellites, the spacecrafts for which may be otherwise underutilized while transiting oceanic regions.

The Commission's ESIMs Further Notice should also address the operation of ESIMs in portions of the V-band. Although it may be premature to consider the operation of ESIMs on an opportunistic basis in the 37.5-40.0 GHz band, it is not premature to adopt rules designating ESIMs as a primary application of FSS in the critically important 40.0-42.0 GHz (space-to-Earth) and 48.2-50.2 GHz (Earth-to-space) bands. These paired spectrum bands have long been recognized by the Commission to be important growth bands for FSS that can be used for new and novel FSS applications, such as facilitating the operation of high capacity ESIMs using phased array antennas and highly directional beams.

Finally, the Commission should adopt further measures to facilitate the licensing of ESIMs networks. To this end, Intelsat and Inmarsat explained why it would be appropriate for the Commission to permit ESIMs applicants to certify that their earth station terminals will comply with the Commission's shut down requirements to ensure compliance with the off-axis power spectral density limits, rather than require a "demonstration" of such compliance.[2] Such a certification requirement would be consistent with the Commission's existing rules regarding antenna pointing and cessation requirements and therefore should be adopted.

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[1] Comments of SES S.A. and O3b Limited, IB Docket No. 17-95, at 3-6 (July 31, 2017) ("*SES/O3b Reply Comments*").

[2] Joint Comments of Kymeta Corporation and Intelsat License LLC, IB Docket No. 17-95, at 4-5 (July 31, 2017) ("*Intelsat Comments*"); Comments of Inmarsat Inc., IB Docket No. 17-95, at 4 (July 31, 2017) ("*Inmarsat Comments*").

## II. THE COMMISSION SHOULD FACILITATE THE INTRODUCTION OF ESIMS IN ADDITIONAL FREQUENCY BANDS

The Commission's NPRM not only proposed the creation of a consolidated service for ESIMs, but also appropriately proposed to authorize ESIMs in the Ka-band band.[3] The FSS operator community was uniform in its support for these proposals, and also expressed support for authorizing ESIMs in additional Ka- and Ku-band frequencies. Although certain parties raised spectrum sharing concerns about some of these proposals, the concerns that were expressed evidence an insufficient understanding of the manner in which ESIMs operate in FSS spectrum using the same interference envelope and protection measures to protect other authorized users of the spectrum. Therefore, although certain of these spectrum sharing concerns merit consideration, none of them should impede the introduction of ESIMs in the Ka-band or in additional portions of the Ku-band.

### A. The Commission Should Authorize ESIMs in Additional Portions of the Ku-band

SES and O3b correctly observe in their comments that ESIMs should be routinely permitted in additional portions of the Ku-band, specifically including the 10.7-10.95 GHz and 11.2-11.45 GHz segments of the Ku-band.[4] Although these frequencies are governed by ITU Radio Regulations Appendix 30B, the Commission has authorized FSS systems to operate in

[3] *See* Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service, *Notice of Proposed Rulemaking*, IB Docket No. 17-95 (May 19, 2017) ("*NPRM*").

[4] *SES/O3b Comments* at 7-8.

these frequencies, including to communicate with earth stations on aircraft and vessels.[5] Importantly, both of these frequency bands are used solely for space-to-Earth communications that therefore the operation of ESIMs in this spectrum cannot result in harmful interference to other satellite or terrestrial services operating in these frequency bands.

### B. The Commission Should Authorize ESIMs in the 17.8-18.3 GHz band on a Secondary Basis with Respect to Terrestrial Licensees

As SES and O3b observed in their comments, the Commission is currently considering in its NGSO FSS proceeding the authorization of FSS systems in the 17.8-18.3 GHz band.[6] Boeing, along with others in the satellite industry, supports this proposal.[7]

To the extent that FSS systems are permitted to operate in the 17.8-18.3 GHz band, the Commission should also permit ESIMs to operate in this spectrum pursuant to the same criteria to protect terrestrial systems. The 17.8-18.3 GHz band would be used by FSS networks for space-to-Earth transmissions and, therefore, the operation of ESIMs in this spectrum could not increase the potential for harmful interference to terrestrial licensees.

### C. The Commission Should Move Forward With its Proposal to Authorize ESIMs in the 18.3-18.8 GHz and 19.7-20.2 GHz Downlink Bands

The Commission's proposal to authorize ESIMs in the 18.3-18.8 GHz and 19.7-20.2 GHz bands received uniform support within the satellite communications industry. The

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[5] *See, e.g.,* Panasonic Avionics Corp., Call Sign E100089 (ESAA license authorizing use of 10.7-12.75 GHz); Blue Marble Network, LLC, Call Sign E100102 (ESV license authorizing use of 11.2-11.7 GHz frequencies).

[6] *See SES/O3b Comments* at 8 (citing Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters, *Notice of Proposed Rulemaking*, 31 FCC Rcd 13651, ¶ 9 (2016)).

[7] *See Comments of The Boeing Company*, IB Docket No. 16-408, at 8-9 (Feb. 27, 2017).

introduction of ESIMs networks in these frequencies will facilitate important new broadband services to end users in difficult to serve locations, such as on aircraft and ships at sea.

Those parties that expressed concerns about aspects of this proposal appear to have an insufficient understanding regarding the manner in which ESIMs function with FSS networks. For example, the National Academy of Sciences, through its Committee on Radio Frequencies ("CORF") expressed concern that ESIMs operating in the 18.6-18.8 GHz band could cause harmful interference to earth exploration satellite service ("EESS") systems operating in the range of 18.7 GHz.[8] CORF put forth two theories regarding why ESIMs might cause interference to EESS satellite receivers. First, CORF raised concern about the potential for ESIMs terminals to transmit upward toward EESS satellites in the range of 18.7 GHz.[9] Second, CORF suggested that the introduction of ESIMs could lead to increased use of the 18.6-18.8 GHz band by FSS networks for downlink transmissions to ESIMs terminals, potentially resulting in increased reflections of satellite signals off the surface of the Earth and into EESS satellite receivers.[10]

Boeing has since reached out to CORF representatives to explain why these concerns are unfounded. First, given the fact that the 18.3-18.8 GHz band is authorized for downlink transmissions from FSS satellites, there is no potential for ESIMs to transmit in an upward direction in this frequency segment. Second, the introduction of ESIMs in the 18.3-18.8 GHz

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[8] *See* Comments of the National Academy of Sciences' Committee on Radio Frequencies, IB Docket No. 17-95, at 6-10 (July 31, 2017).

[9] *See id.* at 9 (arguing that "having additional transmitters on airborne platforms" could increase interference to EESS satellites, particularly "considering that the distance from airplanes to Earth's surface is much smaller than that to satellites, and therefore, their signals will have less attenuation due to a shorter atmospheric path").

[10] *See id.* at 8.

band would not result in additional satellite downlink transmissions in this spectrum, it would just increase the number of fixed and mobile earth stations that would receive those signals on Earth. The total number of FSS networks operating in the Ka-band using geostationary satellites has been governed primarily by the number of spacecraft that can successfully operate in a two-degree spacing environment, not any limits on end user demand for such capacity. Therefore, the introduction of ESIMs should not increase the total amount of FSS space-to-Earth transmissions that are currently experienced in the Ka-band.

Another party, the Elefante Group ("Elefante"), filed comments that do not object to the authorization of ESIMs in the 18.3-18.8 GHz and 19.7-20.2 GHz bands, but appear to seek protection for its yet-unauthorized proposal for stratospheric platforms in this same spectrum.[11] Elefante acknowledges that the Commission does not maintain a Fixed or Mobile Services allocation in the 18.3-18.8 GHz or the 19.7-20.2 GHz bands and its proposed operations would therefore have to be conducted pursuant to waiver or the outcome of a rulemaking.[12] Despite this fact, Elefante suggests that ESIMs be forced to operate using minimum elevation angles or separation requirements to protect this unauthorized service.[13]

Boeing generally supports the development of new technologies, such as the use of unmanned aerial vehicles to support innovative broadband services. The Commission and the ITU, however, have already allocated spectrum for these types of services, which are currently unused. Therefore, the Commission should not impede the development of ESIMs networks in core FSS frequency bands where the satellite industry is already providing critically important

[11] *See* Comments of Elefante Group, Inc., IB Docket No. 17-95, at 1 (July 31, 2017).

[12] *See id.* at 6 n.10.

[13] *See id.* at 7.

broadband communications services to a well-established customer base. Instead, any consideration of Elefante's proposal should be focused on spectrum bands that are not being used for FSS, or on authorizing stratospheric platforms purely on a secondary basis.

### D. The Commission Should Move Forward With its Proposal to Authorize ESIMs in the 28.35-28.6 GHz Uplink Band

The satellite industry expressed uniform support for the Commission's proposal to authorize ESIMs Earth-to-space operations in the 28.35-28.6 GHz band. One party, the Global Mobile Suppliers Association ("GSA"), expressed concern that ESIMs in this spectrum could cause harmful interference to terrestrial operations in the adjacent 27.5-28.35 GHz band. GSA's argument seems to be premised entirely on an assumption that ESIMs may generate more out-of-band interference than conventional fixed earth stations. In fact, all earth stations operating with FSS networks, including ESIMs, are subject to Section 25.202(d) of the Commission's rules, which requires that the "carrier frequency of each earth station transmitter" must be maintained "within 0.001 percent of the reference frequency."[14] Therefore, the introduction of ESIMs will not create any increased potential for harmful interference to terrestrial services in the adjacent 27.5-28.35 GHz band.

### E. The Commission Should Also Move Forward With its Proposal to Authorize ESIMs in the 29.25-30.0 GHz Uplink Band

Operators of FSS networks and ESIMs licensees also expressed support for the Commission's proposal to authorize ESIMs in the 29.25-30.0 GHz band. Iridium, however, argued that ESIMs should not be permitted in the 29.25-29.3 GHz portion of the band, claiming that it would be very difficult, if not impossible, to coordinate ESIMs operations with Iridium's

[14] *See* 47 C.F.R. § 25.202(d).

feeder links.[15] Boeing acknowledges that it would be necessary to enter into a coordination agreement with Iridium to ensure that the operation of ESIMs in the 29.25-29.3 GHz band does not result in harmful interference to Iridium's feeder links. Such discussions would have to take into consideration the geometries of Iridium's feeder links, which operate between a relatively small number of earth stations and Iridium's LEO satellites.

For significantly more than a decade, Boeing has been operating its network of earth stations aboard aircraft ("ESAA") pursuant to coordination agreements with NASA (for the protection of the Tracking and Data Relay Satellite System ("TDRSS") in the 14.0-14.5 GHz band) and the National Science Foundation (for the protection of Radio Astronomy sites monitoring the formaldehyde line in the 14.47-14.5 GHz band). Both of these agreements address the protection of fixed locations and their line-of-sight access to corresponding targets at varying altitudes. Although the development of these agreements was relatively complex, they were achievable. Further, Boeing's day-to-day operations of its ESAA network in the Ku-band has demonstrated that such protection arrangements can be coordinated successfully, ensuring the continued operation of incumbent services in various spectrum bands on a shared basis with ESIMs networks. Boeing therefore believes that – with Commission oversight – similar coordination agreements can be reached with Iridium for the protection of its feeder links from ESIMs transmissions in the 29.25-29.3 GHz band.

## III. CONCLUSION

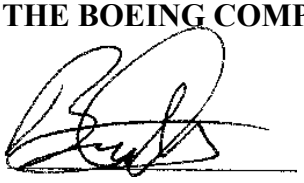
As noted in Boeing's comments in this proceeding, Boeing supports each of the measures proposed in the Commission's *NPRM* for the consolidation and streamlining of its rules for FSS earth stations operating on mobile platforms, and for the expansion of these services using FSS

[15] *See* Comments of Iridium Satellite LLC, IB Docket No. 17-95, at 9-16 (July 31, 2017).

spectrum in the Ka-band. Boeing additionally supports the further measures identified in these reply comments to provide even more flexibility for the licensing the ESIMs and for their effective operation in additional frequency bands.

Respectfully submitted,

**THE BOEING COMPANY**

By: 

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